DCF Utility Valuation: Still the Gold Standard?

Today's volatile markets upset the discounted cash flow model, and others.

BY JONATHAN A. LESSER

First used in the mid-1960s by ratepayer advocates, the discounted cash flow (DCF) method has become the most common approach used to estimate the cost of equity capital for utilities and, hence, allowed returns. Past surveys of regulators have shown a strong preference for the DCF—exclusively so for some state utility commissions, and in conjunction with alternative methods at others.[1] Perhaps such reliance was appropriate in the past, when regulated utility stocks provided "widow and orphan" stability.

But with the restructuring meltdown in California, widespread electric and gas trading fraud, and the broader market accounting scandals, new risk has been injected into energy and financial markets. That risk has been translated into greater price volatility, not only of electricity and gas, but also for regulated utility stocks, which have lost their historic price stability. Unfortunately, of all the "typical" methods used to estimate utilities' cost of equity—DCF, the capital asset pricing model (CAPM), risk premium (RP), and comparable earnings (CE)—the DCF method is, arguably, the most sensitive to short-term market volatility. And, as more utilities reduce or even eliminate dividend payments, the applicability of the DCF method becomes more limited. This does not bode well for primary (or, worse, exclusive) reliance on the DCF unless and until capital and energy markets are more stable. But in the meantime, and in consideration of these new risks, perhaps it is time to rethink the reliance on the DCF method as the *sine qua non* of the cost of capital world.

The DCF Today: Crumbling At Its Foundation?

The DCF's popularity, at least in part, stems from its straightforward nature. However, little attention appears to have been paid to the volatility of the cost of equity estimates derived using the DCF, and the potentially adverse financial impacts that can stem from it. While that may have been appropriate in a stable pre-restructuring world, it is not appropriate today, for a number of reasons. First, utility stock price volatility has increased significantly. Second, the volatility of utility earnings has also increased, making predictions about future earnings growth far more uncertain. Third, restructuring ripped apart the electric industry, including a spate of mergers and acquisitions, forced divestitures, the still-unfinished saga of California, and controversies over price manipulation in gas and electric wholesale markets. The reverberations from all of these continue today, and the ultimate structure of the industry remains unclear. Add to that the stock market's plunge and looming threats of war, and the stable foundations upon which the DCF rests begin to crumble.

One way to illustrate the much higher volatility of utility stocks is to consider the Dow Jones Index of 15 utilities. Although the specific utilities composing this index have changed over time, it still provides a useful snapshot of volatility, as shown in Figure 1.

As Figure 1 (p. 16) shows, the annualized volatility of the Dow Jones Index of 15 utilities remained fairly constant between 1990 and 1999, but increased dramatically during the last three years as the overall stock market bubble deflated. Meanwhile, on the debt side of the ledger, the basis point spread between corporate bonds and long-term Treasuries also increased, as shown in Figure 2 (p. 16). By the end of 2002, the basis point spread between AAA-rated corporate bonds and 10-year Treasuries was double the spread at the end of 1990, and the spread between BAA-rated corporate bonds and 10-year treasuries was more than 50 percent higher.

A more recent development has been the practice by some energy companies to shift their financial burdens brought on by losses from forays into unregulated, and sometimes unrelated, activities onto their utility subsidiaries, further increasing the financial risks on those subsidiaries. And, with significant amounts of corporate debt coming due—more than $25 billion in 2003 alone—energy companies are increasingly turning to higher-cost sources of funds.[2] In response to utilities' worsening balance sheets, bond rating agencies have downgraded many of those utilities' corporate bond ratings to junk bond levels, further increasing the risks borne by utility investors.

Volatility of DCF Estimates: The Ghost in the Machine

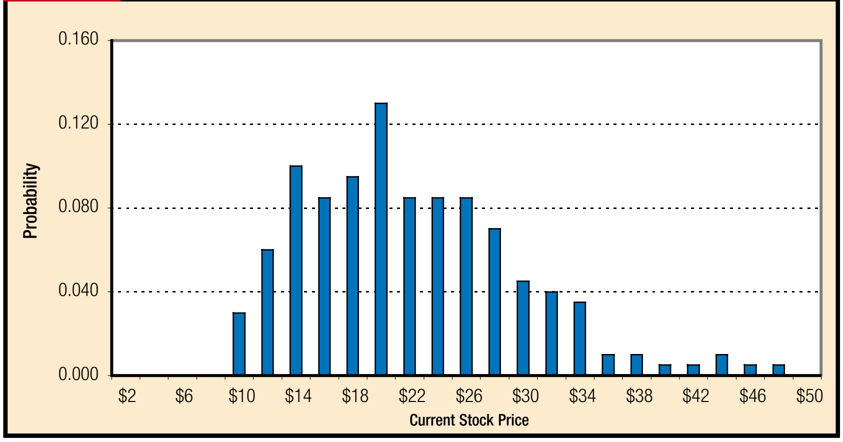
With all of these events, standard DCF calculations are affected in a number of ways. First, as stock price volatility increases, so does the volatility of the calculated dividend yield. Assuming the earnings growth rate was known with certainty, the volatility of the overall cost of equity estimated using the DCF would be the same as the volatility of the dividend yield. If one interpreted the efficient market hypothesis (EMH) strictly and used a single day's closing stock price to calculate the cost of equity, then the utility could be subject to dramatic swings in its allowed return. To see this, consider the following example.

A utility plans to file a rate case sometime this year. Suppose a utility's stock price currently has an estimated annual volatility of 35 percent, just under the average of the annual volatilities for the Electric Utility East companies in Table 1 (p. 18). Suppose the price of the stock is $20 today and that the dividend is $1.00 annually. The current dividend yield (D0/P0) is thus 5 percent. If its projected earnings growth is 5 percent per year, the utility's calculated cost of equity will equal 10 percent.

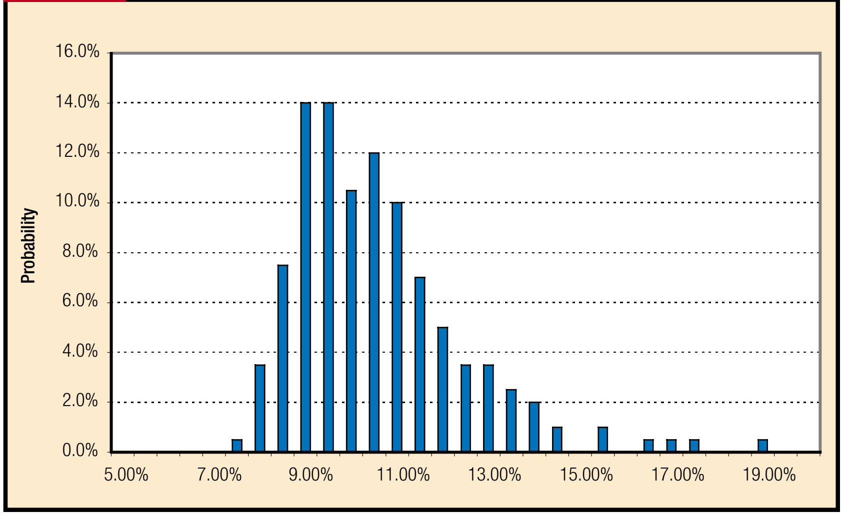
Given the utility stock's volatility and current price, the probability distribution of the stock price will look like that shown in Graph 1.[3] This probability distribution is assumed to be lognormal—the same assumption that underlies much of financial options theory, such as the Black-Scholes option pricing model. Assuming the constant earnings growth rate of 5 percent, the volatility in the stock price will cause the cost of equity (COE) to have the same overall probability distribution when calculated using the DCF, as shown in Graph 2.

The thing to notice in Graph 2 is the large potential variation in the COE, given the volatility of the utili-

GRAPH 1 PROBABILITY DISTRIBUTION OF STOCK PRICE



GRAPH 2 PROBABILITY DISTRIBUTION OF COST OF EQUITY



GRAPH 3 PROBABILITY DISTRIBUTION OF COST OF EQUITY
(BASED ON ALTERNATIVE CLOSING PRICE AVERAGES)

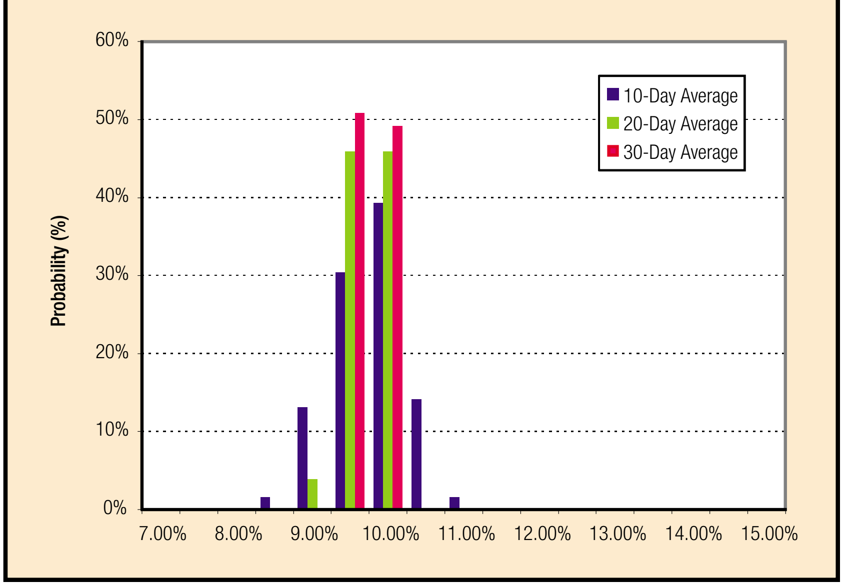


FIG. 1 **VOLATILITY OF THE DOW JONES UTILITY INDEX 1990-2002**

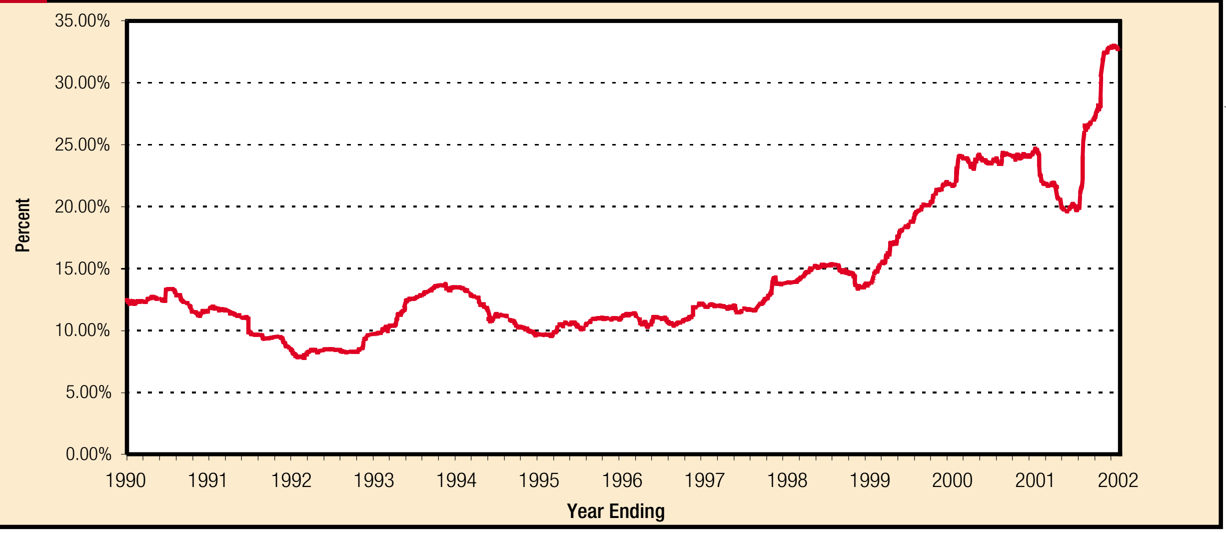
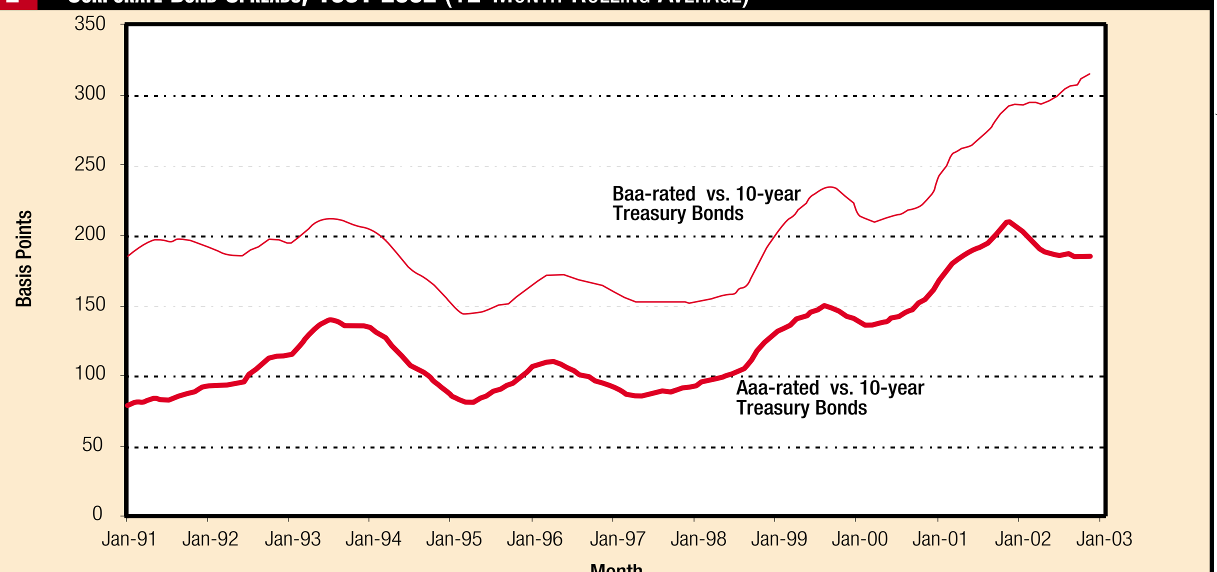


FIG. 2 **CORPORATE BOND SPREADS, 1991-2002 (12-MONTH ROLLING AVERAGE)**



ty's stock price over the year. The COE ranges between 7.5 percent and 19 percent. Thus, applying the DCF based on one day's stock price would imply a potential variation in the calculated COE of more than 1,100 basis points, even before considering the variation in earnings growth forecasts.

The usual method to address daily stock price volatility is to base DCF calculations on an average of recent stock prices.[4] While this violates the theoretical EMH, it reduces (but does not eliminate) the variation in the computed cost of equity. How many trading days to use in computing an average stock price is arbitrary—the greater the number of trading days used, the lower the potential variation. Graph 3 (p.15), for example, shows the probability distributions of the utility's calculated COE, using the same initial 5 percent dividend yield and constant 5 percent earnings growth forecast, based on average stock prices taken over 10-, 20-, and 30-trading-day periods.

Even assuming 30 trading days (6 weeks) are used to average stock prices, the underlying volatility of the utility's stock leads to a 150 basis point variation in the utility's COE. If 10 trading days are used, the variation in the dividend yield is more than 250 basis points. Clearly, such variability could have a tremendous impact on a utility's financial well-being when determining the utility's allowed return.

Of course, compounding this variation are variations in earnings forecasts themselves. Greater volatility in stock prices will lead to greater uncertainty

Foundations of the DCF[7]

The DCF is based on the efficient market hypothesis (EMH), which states, in essence, that the price of a stock today is determined by all of the available information about that stock. Given the "rogue's gallery" of recent corporate accounting scandals, it might be tempting to conclude the EMH is simply wrong, but that is too harsh. Once those scandals were exposed, the EMH quickly adjusted the stock prices of the offending companies.

The DCF model assumes that the stock price today equals the expected value of all future cash flows associated with that stock, including any dividend payments and appreciation in the stock's price.[8] In this framework, the cost of equity for a utility can be shown to equal the stock's current dividend yield plus the expected long-term growth in earnings, i.e.,[9]

$$k = (D0 / P0) + g$$

A number of different versions of the DCF have been used, based on different treatment of dividend payments, differences between short-term and long-term earnings growth rates, and even "non-constant" growth rate models. All of these different versions, however, are based on the same underlying capital market theory.

Before consolidation in the natural gas and electric utility industries, and before it became popular for utilities to diversify into unregulated activities, the cost of equity could be calculated directly for most publicly held utilities. Of course, unlike unregulated firms, regulators themselves, in part, determine the earnings growth component "g," which introduces a circular logic problem into the DCF calculation.[10] To get around these problems, most DCF estimates presented in utility rate cases rely on proxy groups of "similar" utilities, although what constitutes a "similar" utility is more art than science. Indeed, the choice of proxy groups can have a significant effect on the ultimate cost of equity derived. Moreover, the availability of proxy companies has decreased as mergers and restructuring has reduced the number of independent utilities on which comparisons could be made.[11]

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about future earnings. That uncertainty, expressed in more disparate earnings forecasts, may adversely affect a utility's bond rating by raising default risk, further pressuring cash flows, and introducing still more uncertainty into future earnings forecasts. None of this bodes well for relying solely on the DCF.[5]

DCF & Earnings Growth Uncertainty

In the traditional DCF form, the cost of equity equals the sum of the current dividend yield and a forecast of long-term earnings growth. Although different versions of the DCF attempt to address potential differences between short-term and long-term forecasts of earnings growth rates, there is generally little discussion of how those forecasts are determined.

Separate earnings growth forecasts are not typically developed for use in DCF studies. Instead, analyst forecasts developed by well-known financial analysis firms (e.g., Thompson-I/B/E/S, Zack's, Value Line) are used. Typically, these firms provide projections of earnings growth looking out five years. As an example, consider the earnings growth data presented in Table 1 (p. 18). This table lists all of the electric and natural gas utilities tracked by the Value Line Investment Survey for which long-term earnings growth forecasts were published by Thompson-I/B/E/S at the end of December 2002. For each utility with three or more estimates, the mean, high, low, and median estimates are presented.

The table shows the percentage point spread between high and low earnings growth estimates, and the ratio of that percentage point spread to the mean earnings growth rate. For example, Thompson-I/B/E/S reports on the results of 10 separate analyst estimates for Allegheny Energy. The mean long-term earnings growth forecast is 6.2 percent, the spread between the high and low growth estimates is 13 percent (15%-2%), and the ratio of the spread to the mean growth estimate is 2.1 (13/6.2).

For the 65 electric and natural gas utilities shown in Table 1, the average ratio of the low-to-high spread in earnings growth to mean earnings growth is 1.1. That is, the spread in the earnings estimates is greater than the average estimates themselves. Additionally, while one might expect that Western electric utilities would have greater earnings uncertainty than either Central or Eastern utilities because of the California restructuring meltdown, this is not the case. In fact, earnings-growth-estimate volatility for Western electric utilities was the lowest, on average, of the three categories. Gas distribution utilities have, on average, less uncertainty in their earnings growth

TABLE 1 **FIVE-YEARS' EARNINGS FORECASTS**

Source: Thompson - I/B/E/S

	Company	No. of Estimates	Mean (%)	High (%)	Low (%)	Median (%)	High/Low Spread (%)	Ratio of Spread/Mean
	Electric Utility East							
1	Allegheny	10	6.2	15.0	2.0	5.0	13.0	2.10
2	Consol. Edison	9	3.7	5.0	2.0	4.0	3.0	0.82
3	Constellation Energy	11	8.2	20.0	3.0	7.0	17.0	2.08
4	Dominion Resources	17	7.8	14.3	5.0	7.0	9.3	1.20
5	DQE	8	4.8	7.0	3.0	4.5	4.0	0.84
6	Duke Energy	16	8.0	15.0	1.0	7.5	14.0	1.75
7	Energy East	7	6.6	11.3	3.0	6.0	8.3	1.26
8	Exelon	13	6.0	8.5	4.0	6.0	4.5	0.75
9	FPL Group	16	6.0	7.0	4.0	6.0	3.0	0.50
10	Northeast Utilities	6	5.7	15.0	2.0	4.0	13.0	2.29
11	NSTAR	4	6.3	7.0	5.0	6.5	2.0	0.32
12	Pepco Holdings	8	4.7	8.5	2.0	5.3	6.5	1.39
13	PPL Corp.	10	6.6	10.0	4.0	6.0	6.0	0.92
14	Progress Energy	13	6.5	13.0	3.0	7.0	10.0	1.53
15	Public Service Enterprise	16	5.7	7.0	3.0	6.0	4.0	0.70
16	SCANA Corp.	3	5.0	6.0	4.0	5.0	2.0	0.40
17	Southern Co.	14	5.4	8.5	4.0	5.0	4.5	0.83
18	TECO Energy	13	5.9	13.0	3.0	5.0	10.0	1.70
	Average	**10.8**	**6.1**	**10.6**	**3.2**	**5.7**	**7.5**	**1.19**
	Electric Utility Central							
1	Allete	5	8.0	13.0	4.0	8.0	9.0	1.13
2	Alliant Energy	5	4.5	6.0	3.0	4.5	3.0	0.67
3	Amer. Elec Power	11	5.1	8.0	2.0	4.0	6.0	1.17
4	Ameren	8	3.6	6.0	2.0	3.0	4.0	1.10
5	Aquila	7	4.6	10.0	3.0	4.0	7.0	1.53
6	Cinergy	12	4.9	7.0	2.0	5.0	5.0	1.02
7	CMS Energy	11	5.0	10.0	3.0	4.0	7.0	1.40
8	DPL	11	7.3	16.0	3.0	6.0	13.0	1.79
9	DTE Energy	9	6.8	8.0	5.0	7.0	3.0	0.44
10	Empire Dist Elec	3	5.7	10.0	3.0	4.0	7.0	1.23
11	Entergy	13	8.2	17.0	3.0	8.0	14.0	1.70
12	FirstEnergy	10	6.6	8.0	5.0	7.0	3.0	0.46
13	Great Plains Energy	3	4.7	5.0	4.0	5.0	1.0	0.21
14	NiSource	10	6.0	10.0	3.0	5.0	7.0	1.17
15	OGE Energy	4	4.3	5.0	3.0	4.5	2.0	0.47
16	TXU Corp.	15	6.9	10.0	1.0	7.5	9.0	1.30
17	Vectren	6	7.5	10.0	5.0	7.5	5.0	0.67
18	Wisconsin Energy	7	7.0	16.0	4.0	6.0	12.0	1.71
19	WPS Resources	3	6.0	7.0	5.0	6.0	2.0	0.33
	Average	**8.1**	**5.9**	**9.6**	**3.3**	**5.6**	**6.3**	**1.03**
	Electric Utility West							
1	Avista	5	7.4	20.0	4.0	4.0	16.0	2.16
2	Black Hills	3	11.3	15.0	9.0	10.0	6.0	0.53
3	Edison Int'l	9	7.7	12.0	3.0	8.0	9.0	1.17
4	Hawaiian Electric	4	3.1	6.0	2.0	2.3	4.0	1.28
5	IDACORP	3	8.0	8.0	8.0	8.0	0.0	0.00
6	MDU Resources	9	9.4	12.0	7.0	10.0	5.0	0.53
7	PG&E Corp.	9	6.7	9.0	2.0	8.0	7.0	1.05
8	Pinnacle West	9	5.9	10.0	3.0	6.0	7.0	1.19
9	PNM Resources	4	5.7	10.0	2.7	5.0	7.3	1.29
10	Puget Energy	5	5.8	8.0	4.0	6.0	4.0	0.69

11	Sempra Energy	9	7.2	10.0	3.0	8.0	7.0	0.97
12	Sierra Pacific	5	4.7	6.0	3.0	5.0	3.0	0.64
13	Xcel Energy	13	6.2	13.0	2.0	7.0	11.0	1.79
	Average	**6.7**	**6.9**	**10.7**	**4.1**	**6.7**	**6.6**	**1.02**
	Natural Gas Distribution							
1	AGL Resources	8	7.0	10.0	3.0	7.5	7.0	1.00
2	Atmos Energy	7	6.7	10.0	5.0	6.0	5.0	0.75
3	Energen	5	7.0	9.0	5.0	7.0	4.0	0.57
4	KeySpan	9	7.9	10.0	6.0	8.0	4.0	0.51
5	New Jersey Resources	3	6.7	8.0	5.0	7.0	3.0	0.45
6	NICOR	6	5.2	7.0	3.0	5.5	4.0	0.77
7	NW Natural Gas	3	5.7	8.0	4.0	5.0	4.0	0.71
8	NUI Corp.	3	5.3	10.0	1.0	5.0	9.0	1.69
9	Peoples Energy	8	5.5	7.0	3.5	5.3	3.5	0.64
10	Piedmont Natural Gas	4	4.5	5.0	4.0	4.5	1.0	0.22
11	SEMCO Energy	4	4.5	10.0	2.0	3.0	8.0	1.78
12	Southern Union	2	7.0	9.0	5.0	7.0	4.0	0.57
13	SW Gas	4	5.0	6.0	4.0	5.0	2.0	0.40
14	UGI Corp.	4	6.9	8.0	4.5	7.5	3.5	0.51
15	WGL Holdings	5	4.4	5.0	4.0	4.0	1.0	0.23
	Average	**5.0**	**5.9**	**8.1**	**3.9**	**5.8**	**4.2**	**0.72**
	Overall Averages	**7.8**	**6.2**	**9.8**	**3.6**	**5.9**	**6.2**	**1.00**

Data Updated on Dec. 28, 2002

forecasts than do electric utilities. That is not unexpected, since the gas industry has experienced relatively less instability than the electric industry.

Some Possible Solutions to The DCF Conundrum

There are a number of potential solutions to the problem of volatile DCF estimates. While abandoning the DCF might come to mind, that raises the question of what to replace it with. No single methodology can ever provide the "correct" rate of return, because market conditions change much faster than regulators act. Moreover, the allowed rate of return ultimately decided upon by regulators will almost always encompass more than just investment efficiency; it will also incorporate equity concerns, judgments about a utility's management capability, corrections for past "wrongs," and even political calculations.[6]

First, and foremost, the cost of equity should be determined in consideration of overall market trends, not just a snapshot of current conditions. While the EMH states that today's stock price reflects all expectations about the future, those expectations can change quickly. The more volatile a utility's stock price, the less likely current market expectations will reflect longer-term financial realities going forward. Thus, one approach is to examine the nature of stock price volatility and earnings growth uncertainty. Is there increasing seasonality of earnings? Has the stock price been trending downward or upward, especially in comparison with broader market trends? Performing regression analysis can help determine whether real trends exist and, depending on the results of the analysis, influence the allowed rate of return. It's also important to understand that examining trends is not the same thing as just selecting average values, whether the "average" stock price or the "average" of the analysts' earnings growth forecast.

Using the DCF with other methodologies is another solution. More importantly, however, is examining the differences in the results produced and the causes of those differences. If a DCF analysis determines a cost of equity of 12 percent, while the CAPM determines 8 percent, the risk premium 13 percent, and the comparable earnings approach 9 percent, the "correct" cost of equity, at least from the standpoint of the "commensurate" risk standard set out in the Supreme Court's 1944 *Hope Natural Gas* decision is unlikely to be the simple average of all four methods.

Finally, automatic adjustment mechanisms that change the allowed rate of return based on financial market conditions should be considered. Besides being responsive to the increasing volatility in those markets, such mechanisms can overcome the problem of regulatory lag. Of course, as with many regulatory issues, the devil is in the details. Nevertheless, in principle, an automatic adjustment mechanism could work in much the same way as a well-structured performance-based regulation scheme: providing the utility with an incentive to improve efficiency, while sharing some of the benefits of those improvements with ratepayers.

Whatever the solution, traditional reliance on the DCF needs rethinking by regulators. At the very least, regulators should no longer rely solely on the DCF to set allowed returns. As long as markets remain volatile—and it seems unlikely that the utility industry will return to its "widows and orphan" days—efficiency and equity considerations both suggest more explicit treatment of that market volatility in determining utilities' cost of equity and allowed rates of return. The DCF need not be abandoned—yet—but its use needs to be modified to account for the very different financial markets that face utilities today.

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Endnotes

1. National Association of Regulatory Utility Commissioners (NARUC), "Utility Regulatory Policy in the United States and Canada, Compilation," 1996. The author also relied on a study of utility commission rate case decisions between 1993 and 2001 provided by *Public Utilities Report's Regulatory Research Service.*

2. See, "Utilities' Loans Are Offers They Can't Refuse," *The Wall Street Journal,* Dec. 27, 2002.

3. The actual figure was generated using a Monte-Carlo model.

4. The mathematics of the DCF tends to drive a utility's stock price to its book value, since, as a utility's stock price increases above book value, the dividend yield falls. This lowers the calculated cost of equity and, if translated directly to the utility's allowed return, will reduce earnings and, therefore, the utility's stock price. For a utility trading below book, the opposite effect occurs, driving the stock price up.

5. One proposed solution has been to use a non-constant growth model during a "transition" period, and then a long-term growth rate. This raises two problems: How is the transition period defined, and how are growth rates during this transition period determined?

6. Capital market efficiency and ratepayer equity may be at odds for different utilities that operate under a single holding company. Efficiency dictates that the cost of equity for the individual subsidiaries should be the same, since investors see the risk of the holding company, not the individual subsidiaries. Ratepayer equity, however, may lead regulators to impose different allowed returns on the subsidiaries, so that (say) gas company ratepayers are not also paying for electric market volatility, and vice versa.

7. A thorough discussion of the evolution of the DCF can be found in Win Whitaker, "The Discounted Cash Flow Methodology: Its Use in Estimating a Utility's Cost of Capital," *Energy Law Journal* 12 (1991), pp. 265-290.

8. The theory underlying the DCF holds for any stock, not just a utility. However, historically the use of the DCF to estimate utilities' cost of equity was ideally suited because utilities paid steady dividends.

9. The derivation of this formula can be found in many financial textbooks.

10. For one approach to the diversification problem (written prior to electric industry restructuring and retail competition), see Jeff Mackholm and Donald Sanfer, "Calculating Fairness," *Public Utilities Fortnightly,* Nov. 15, 1993, pp. 41-45.

11. Typically, proxy group companies include those followed by the Value Line Investment Survey. In 1998, Value Line followed 27 natural gas distribution companies. Today, that number is lower by one-third,

DCF analysis is a widely adopted business valuation approach among investors, business managers and corporate finance professionals. However, tribunals in investment treaty disputes are sometimes reluctant to rely on it. Conversely, cost-based valuation methods are rarely used in valuation practice while tribunals frequently make awards of damages based on them. In this article, we consider the usefulness of each of DCF analysis and cost-based approaches as valuation methods and as tools for quantifying losses. We then explore the reasons for the apparent divergence between the attitudes of tr We are finding the present value of the future expected cash flows, using an estimated cost of capital. DCF = C 1 /(1+r) + C 2 /(1+r) 2 + â€¦ Typically analysts forecast the CFs out for five or 10 years, and then add a terminal value, or continuing value, which reflects all future CFs after that point in time. For instance, DCF = C 1 /(1+r) + C 2 /(1+r) 2 + â€¦ + C 5 /(1+r) 5 + TV 5 /(1+r) 5 The CFs may be enterprise CFs or equity CFs. This method works either way, but the discount rate must properly match the stream of cash flows. If the cash flows are cash flows to all providers of capital to th The DCF and RO valuation models will be performed under static and Monte Carlo cash flow modelling. For the Monte Carlo model, gold price uncertainty is described over the life of the project by a discretised geometric Brownian motion diffusion process. dS = a Sdt + s Sdz. where S is the current price, Î± is the instantaneous rate of drift, Ïƒ is the price volatility, and dz is a Wiener process. The discretisation is easiest to carry out in log space, In St+Dt = In St + aDt + s Dtet , where et : N (0,1) is an independent and identically distributed random draw from the standard normal distributi